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MAY 1973, No. 5

FISHING INFORMATION

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL
MARINE
FISHERIES
SERVICE

OUTHWEST
FISHERIES
CENTER
LA JOLLA,
CALIFORNIA

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
SOUTHWEST FISHERIES CENTER
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FISHING INFORMATION

MAY 1973, No. 5

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PREFACE

This publication, Fishing Information, appears monthly and contains 1) fishery advisory information, 2) a narrative description of pertinent surface temperature conditions, 3) a narrative description of subsurface temperature structure for parts of the North Pacific, 4) charts of winds and pressures for the eastern North Pacific, 5) charts of sea surface temperature for the North Pacific and eastern tropical Pacific, and 6) charts of subsurface temperature structure in the eastern North Pacific.

A supplement to Fishing Information appears at 15-day intervals throughout the year. This is a chart of sea surface temperature (contoured at 2°F (1°C) intervals) from Baja California to Vancouver Island out to about 135°W. Special bulletins are published in conjunction with the 15-day sea surface temperature charts which include short-term projections of albacore distribution and locations of productive fishing areas, information on oceanographic and atmospheric conditions, and other information as is appropriate during the albacore fishing season.

R. Michael Laurs, Leader
Fishery-Oceanography Investigations
La Jolla, California

Submitted for publication - June 19, 1973

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J. L. Squire (Figure 12)

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Expendable bathyghermograph observations are made by the Mates of the S. S. Hawaiian Enterprise of Matson Navigation Co., and processed with assistance from the NMFS Environmental Group, Monterey: Project partially supported by National Science Foundation Grant AG-256.

Albacore Tuna Forecast for 1973

R. Michael Laurs and Staff
Fishery-Oceanography Investigations

This is the 13th annual advisory to be issued by the National Marine Fisheries Service for the albacore fishery off the North American Pacific Coast.

Based on 1) environmental conditions, and 2) the results of early season scouting it appears that the major portion of the albacore catch this season should be taken in waters north of San Francisco. It is estimated that as much as 75% of the total catch could be taken north of San Francisco, with most of the production from waters in the Pacific Northwest. Best fishing south of San Francisco should be from central California waters; however, good catches could be expected off southern California and northern Baja California early in the season. Very good early-season fishing is also expected in offshore waters between about 145° to 135°W during June between about 33° to 37°N and during July between about 37° to 42°N.

It is estimated that approximately 50 million pounds of albacore will be caught north of San Francisco and approximately 20 million pounds south of San Francisco. However, these estimates of albacore landings could be low if there is a large influx of additional boats into the fishery or if many boats fish in the offshore waters.

Sports boats operating in southern California waters should have a good albacore fishing season. However, warm water conditions could develop in southern California waters in late summer and limit fishing success.

The prediction of the general distribution of the albacore fishery is based on 1) an experimental index developed at the NMFS La Jolla Laboratory which relates the north-south distribution of the fishery with oceanographic conditions in the spring months in certain offshore waters, 2) the position of the 60° F (15.6° C) isotherm which was as much as 3° latitude further north than normal in waters offshore of about 120°W during late May, 3) the projected distribution of atmospheric pressure distribution which should result in warming of ocean surface waters at a rate faster than normal, especially in the Pacific Northwest, and 4) the fishing results from scouting in offshore waters.

The estimates of tonnages that are expected to be landed during the 1973 season are based on statistical calculations with historical data and adjusted for expected increases in fishing effort. Population dynamics research is underway at the NMFS La Jolla Laboratory and elsewhere which should enable us in the future to make more accurate estimates of tonnage and general size distribution of the fish that will enter the fishery.

AVERAGE SEA SURFACE TEMPERATURE

The 13-year average (1960-1972) of optimum temperature zone for albacore for the July 1-5 period is shown in the shaded portion of plate 1. The majority of the albacore caught in North American waters are taken in waters of this temperature range. Prevailing weather during this period in 1973 will likely cause deviations from this average pattern which may influence the distribution of albacore. We will monitor the evolving temperature patterns in order to project the albacore distribution as the season develops.

RECENT TRENDS IN OCEANIC AND ATMOSPHERIC CONDITIONS

Sea surface temperatures rose sharply during the last half of May from Vancouver Island to Cape Mendocino and offshore to 130°W. Rapid warming also took place in southern coastal waters from Pt. Conception to the Mexican border and in ocean waters more than 250 miles offshore, between latitudes 30° and 40°N. As a result of this warming, sea surface temperatures were above the long-term mean along the coast north of Cape Mendocino. Maximum departures of 4° F (2.2° C) occurred in the vicinity of Cape Blanco. Temperatures south of Pt. Conception, which had been several degrees below the long-term mean in the first part

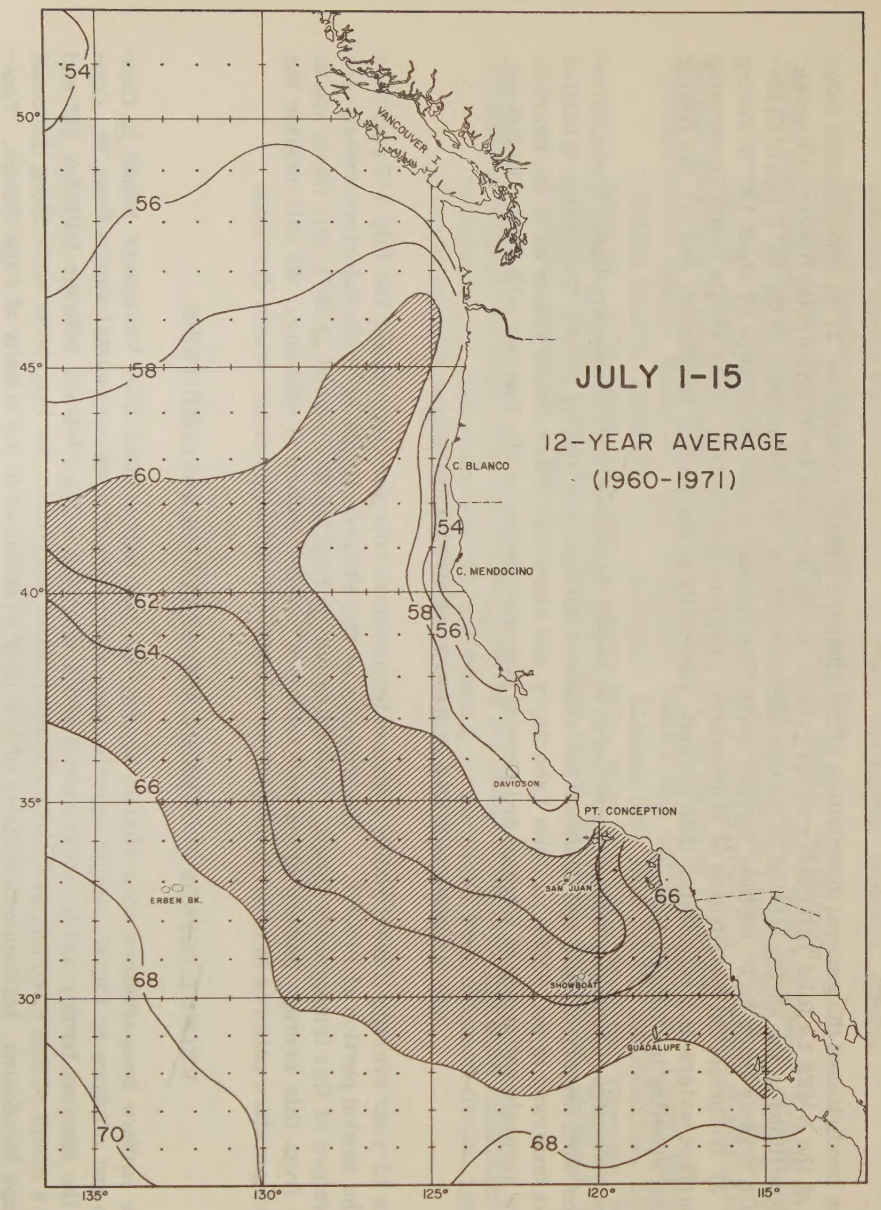


Plate 1.--Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

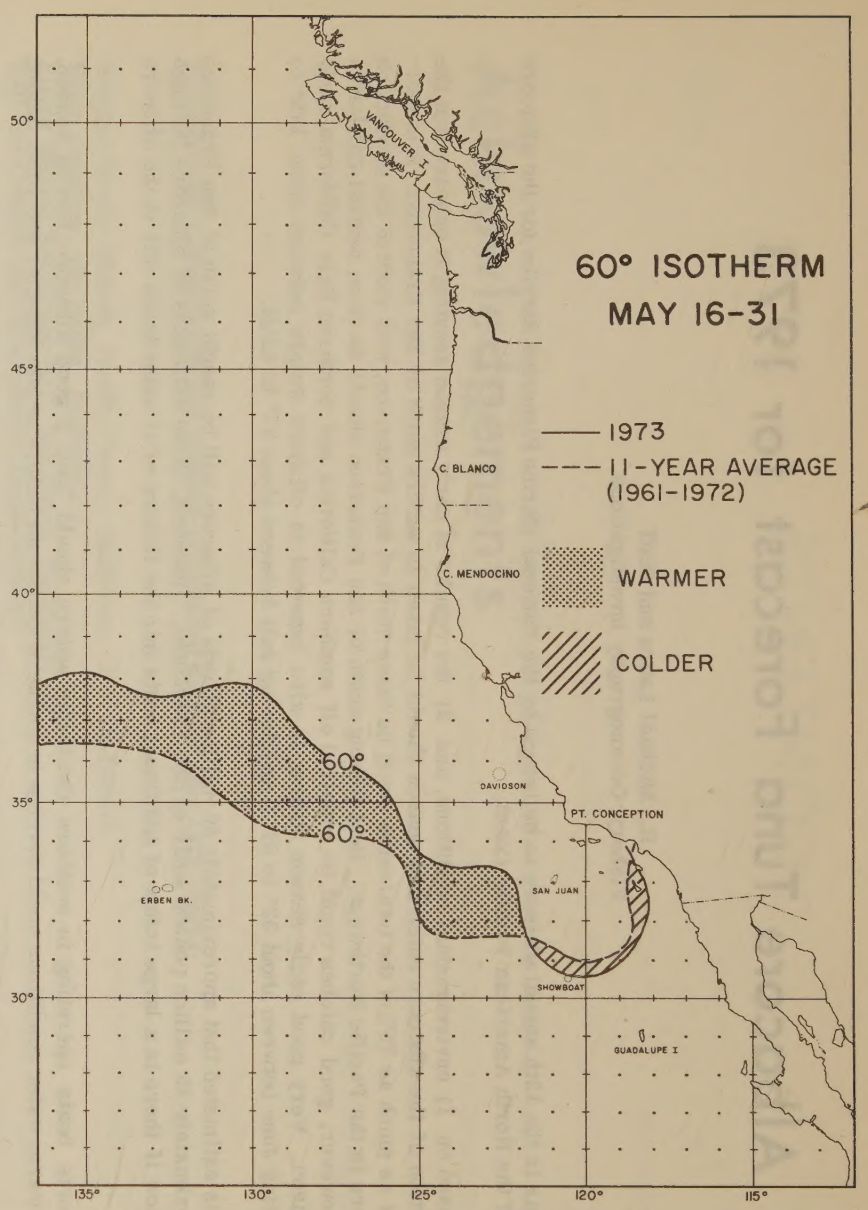


Plate 2.--Relation of position of May 16-31, 1973, 60°F. limiting isotherm to long-term average position for the same interval.

of May, were generally near normal in the latter part. In the region between Cape Mendocino and Pt. Conception, out to 125° W temperatures remained below the long-term mean. Farther offshore, temperatures during May 16-31 were above normal and the 60° F (15.6° C) isotherm was displaced as much as 3° latitude north of the normal pressure for the last half of May in the area offshore of 120° W (plate 2).

During the fall and winter of 1972-1973, the central part of the eastern North Pacific, south of the Gulf of Alaska from 30° to 45° N was characterized by warmer than normal surface temperature. Coastal waters, during this period had below-normal temperatures north of about 40° N and above-normal temperatures south of this latitude. This pattern began to break up in February with a general diminishing in the magnitude of departures from normal temperature, and by April the offshore warm pool had vanished and sea temperatures in the entire coastal region and offshore to 135° W were generally below the long-term mean. The onset of intense seasonal warming in late May reversed this condition in coastal waters north of 40° N and in offshore waters beyond 125° W.

The large central pool of relatively warm water west of 140° W evolved in October 1972 when unusually high atmospheric pressure occurred in the eastern Gulf of Alaska and strong southerly winds prevailed between 140° and 160° W, north of latitude 35° N. A high frequency of southerly winds in this area continued until February 1973. In March and again in May, atmospheric pressure was below normal in the Gulf of Alaska and above normal south of 40° N and west of 150° W. This distribution indicates higher-than-normal frequency of northwesterly winds in the intervening region, which contributed to the dissolution of the warm temperature condition. Mean pressure gradients in May were very weak east of 150° W along latitudes 30° and 35° N and out to about 250 miles offshore from Vancouver Island to Cape Mendocino which reduced evaporation heat loss and permitted the rapid warming of surface waters in that region.

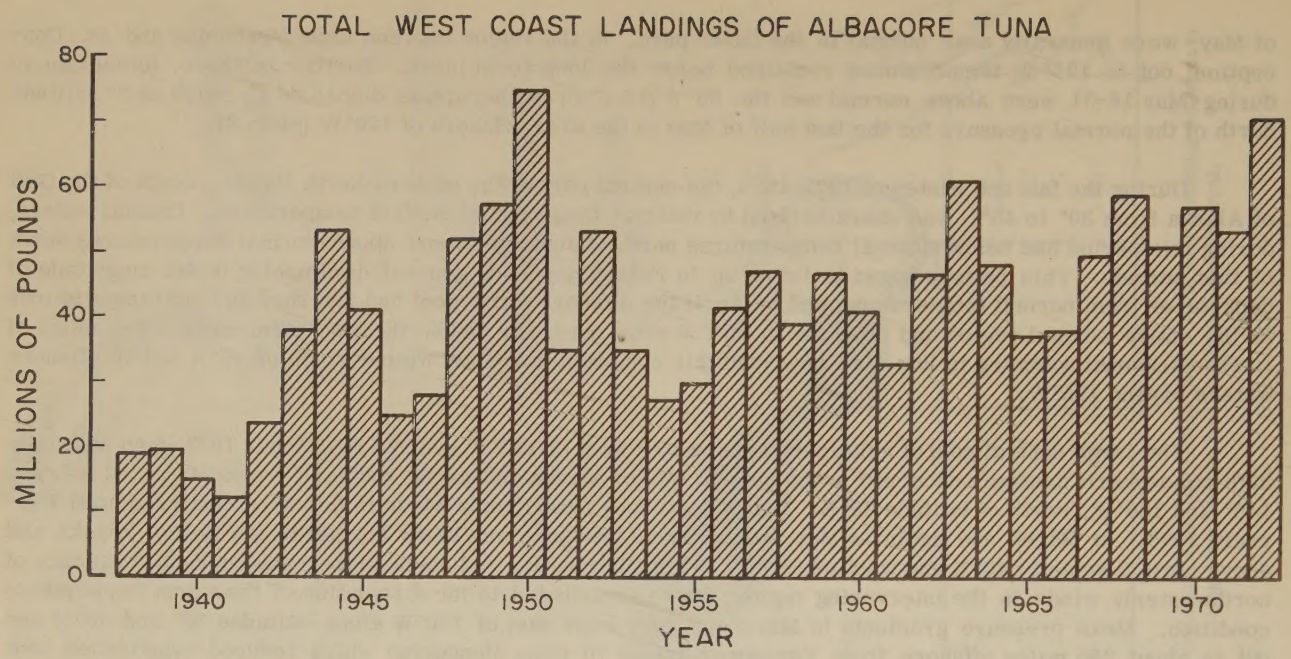
According to the Extended Forecast Division of the National Weather Service, atmospheric pressure distribution over the eastern North Pacific and western U.S. are expected to be above normal during June and also to some degree over the entire summer season. As a result, surface waters offshore the west coast should warm at a rate faster than the normal, and the large-scale thermal anomalies should remain appreciably above normal throughout the summer.

HISTORICAL TRENDS IN CATCHES

Seasonal landings of albacore tuna for the Pacific west coast (U.S. and Canada) for the period 1938-1972 are shown in plate 3. This graph does not take into account changes in fishing effort or efficiency. West coast landings for the 1972 season, based on preliminary information were approximately 71 million pounds, which is the second highest seasonal total in history and considerably above the 1963-1972 average, 51.6 million pounds. The large catch taken during 1972 was in part due to 1) the very good fishing conditions and ability of fishermen to stay on the fish in waters off British Columbia, 2) the reasonably good fishing off central California near the end of the season, and 3) probably to an increase in the number of boats that fished albacore. According to the several industry sources, more vessels fished for albacore in 1972 than in recent years. A further increase in fishing effort is expected this year since many additional boats are planning to enter the albacore fishery.

The percentage of the total west coast catch taken north of San Francisco for the period 1938-1972 is shown in plate 4. The percentage north-south distribution of the catch reflects the large shifts in the location of the centers of the albacore fishery which have taken place over the last three decades.

The fishery swung sharply northward in 1972, interrupting what appeared to be a shift to southern waters. An interruption in the southern trend of the fishery also occurred in 1958 and 1959 following an El Niño off South American waters and anomalously warm waters along the North American west coast. Strong El Niño conditions also occurred off South America in 1972.



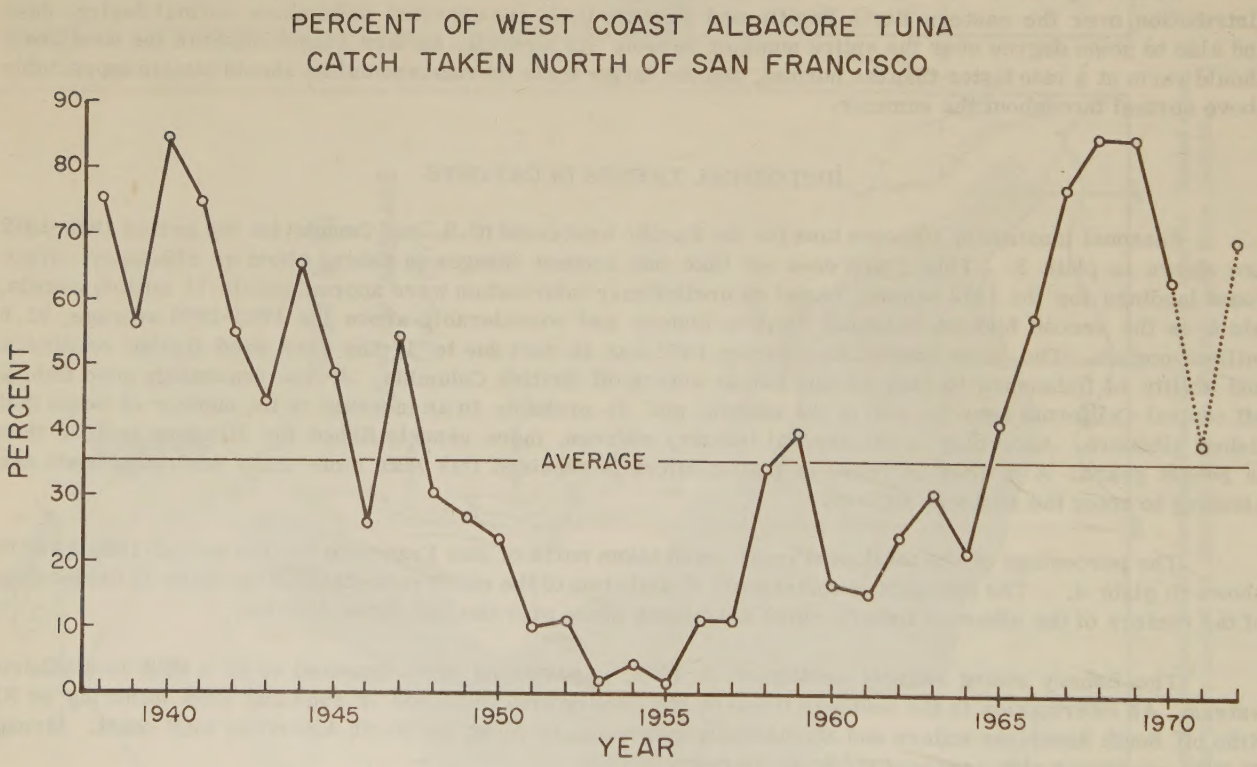


PLATE 3. — Top graph: Total west coast landings of albacore tuna in millions of pounds, 1938–1972.

PLATE 4. — Bottom graph: Percent of west coast albacore tuna catch taken north of San Francisco, 1938–1972.

Albacore landings by states for recent years are as follows:

Albacore landings by state for 1968-1972
(in millions of pounds)

	1972*	1971*	1970	1969	1968
California	23.0	36.1	29.9	14.7	15.1
Oregon	23.6	8.4	21.8	29.8	37.8
Washington	16.2	5.3	4.3	3.5	3.0
British Columbia	7.6	3.7	1.6	2.5	2.6

*Preliminary

NMFS ADVISORY OPERATIONS FOR THE 1972 SEASON

The NMFS La Jolla Laboratory will issue albacore advisory information throughout the 1973 season in addition to the above forecast. The advisory information will include sea surface temperature charts, narrative albacore fish bulletins, and daily broadcasts of albacore fishing information over marine radio bands.

The albacore fish bulletins will be issued twice each month from June 15 until the season ends, in conjunction with 15-day sea surface temperature charts which cover the area roughly between central Baja California and Vancouver Island out to 135°W. The bulletins will include short-term projections of albacore distribution and locations of productive fishing areas, information on oceanographic and atmospheric conditions, and other information as is appropriate.

All the NMFS fishery advisory materials are mailed to fishermen upon request and are bulk-mailed to fish buyers and processors for further dissemination to fishermen.

Daily broadcasts of albacore fishing information will also be prepared by the La Jolla Laboratory and will be transmitted over marine radio bands again this year. The broadcasts will be made twice daily on weekdays and once on Saturday mornings from July 9 through October 31, or until the albacore season ends. The broadcasts will include the latest albacore fishing information obtained from research vessels, cooperating fishing vessels, and unloading station operators. Highlights will include location of active centers of fishing, typical fishing scores, size of fish, sea surface temperature and subsurface temperature information when available, and other information as appropriate. Sports boat albacore fishing activity will also be included. A weather and sea state summary prepared by the National Weather Service will also be given including large-scale weather features, regional wind, weather, and sea state conditions between 20 to 250 miles offshore, and storm development. In addition, each 15 days the broadcast includes map coordinates for the 15-day average position of the 60° (15.6° C) and 64° F (17.8° C) isotherms for the region east of 135°W longitude and between 25° and 50°N latitude. NMFS will also transmit weekly charts of sea surface temperature via radio facsimile over radio station WWD.

Nearly coast-wide reception of the albacore fishery advisory broadcasts will be available this year. The broadcasts will be transmitted by 1) radio station WWD, which is licensed to the NMFS and located on the Scripps Institution of Oceanography (SIO) campus at La Jolla, California, 2) Coast Guard radio station NMC at Point Reyes, 3) radio station KRED in Eureka and 4) the Astoria Marine Operator, KFX. The schedule and frequencies for the broadcasts are as follows:

WWD (La Jolla, California) on SSB carrier frequencies 4409.4, 8644.1, 8789.6, and 13147.5 kHz at 0615 and 1745 PDT weekdays and 0715 PDT on Saturdays.

KFX (Astoria Marine Operator) on 2598 kHz at 0630 and 1945 PDT.

KRED (Eureka, California) on commercial AM 1480 kHz at 0600 and 2000 PDT.

NMC (Point Reyes Coast Guard) on AM compatible frequency 2670 and on SSB carrier frequencies 4383.8, 8732.1, 13147.5 kHz at 0645 and 1945 PDT.

To determine the upper sideband assigned frequencies for tunable receivers add 1.4 kHz to WWD and NMC carrier frequencies.

WWD will transmit charts of sea surface temperature during the fishing season for the area of the albacore fishery on upper SSB carrier frequency 8644.1 kHz. Broadcasts will be made at 1030 PDT on Thursdays starting June 28.

The success of the albacore advisory program depends on the input of timely, first-hand information from fishermen at sea, as well as from dock operators and processors. Fishermen are encouraged to report oceanographic, weather, and fishing information. As a channel of communication for such information radio station WWD will operate the following voice single side-band frequencies and schedules.

Carrier Frequencies

WWD Transmit	WWD Receive
4409.4	4410.8
8789.6	8255.6
13147.5	12368.5

Hours of operation are 0600 to 1800 local time during weekdays and 0800 to 1700 on weekends. Information may also be radioed to the Western Fishboat Owners Association, call letters WHG, and the NMFS La Jolla Laboratory will accept collect calls from fishermen at sea to report oceanographic, weather, and fishing information.

For further details concerning the National Marine Fisheries Service albacore information, please contact:

Director
National Marine Fisheries Service
Southwest Fisheries Center
P.O. Box 271
La Jolla, California 92037

Telephone (714) 453-2820

JOINT NMFS-AFRF ALBACORE RESEARCH STUDIES FOR 1973

The National Marine Fisheries Service La Jolla Laboratory and the American Fishermen's Research Foundation are conducting cooperative albacore tuna field studies during the 1973 season. The purposes of the cooperative studies are to further investigate the shoreward migration of albacore tuna into the North American west coast fishery and the associated marine environmental factors that could influence the migration, and to study the early-season distribution of albacore in the offshore and nearshore regions. This study is designed to improve our understanding of the underlying factors affecting the prediction of the onset and subsequent development of the fishery, and to examine the possibilities for fishermen both to extend the fishery farther offshore and to start the fishery earlier than is usual.

Operations are being conducted by 12 commercial fishing vessels on charter to AFRF and the NMFS research vessel David Starr Jordan, and will include fishery-oceanography, conventional tagging, and tracking of albacore by the use of ultrasonic equipment.

Sea Surface Temperature and Environmental Conditions

L. EBER AND F. MILLER

Eastern North Pacific

Sea surface temperatures increased everywhere in the eastern north Pacific during May 1973 by amounts ranging from 0.5° F (0.3°C) to more than 3° F (1.7°C). The rate of warming was a little below normal south of the Alaska Peninsula from 40° to 45°N, and above normal in the region from 135° to 150°W between latitudes 30° and 45°N. The results of this anomalous heating is shown in Figure 5 as a spreading, since April, of negative sea temperature deviations west of 140°W and north of 45°N, while positive deviations have spread in areas south of 45°N. Figure 5 also shows negative deviations of 2° F (1.1° C) or more off central California out to 130°W.

Mean atmospheric pressures were as much as 8 millibars below normal in the region just south of the Alaska Peninsula and Kodiak Island. Pressures were above normal by about 4 millibars in the region northwest of Hawaii between 25° and 30°N (Figures 1 and 2). As a result, strong west to northwest winds occurred from 40° to 50°N, west of 150°W, and helped reduce surface warming by causing increased evaporation and mixing with cooler subsurface water. Further east, between 135° and 145°W, the mean resultant winds in May were more southerly than normal north of latitude 30°N, and contributed to increased warming of surface waters by aiding northward transport into the Alaska gyre and retarding southward transport in the California Current.

Eastern Tropical Pacific

From all indications in the sea surface temperatures (Figure 7) and the temperature anomalies (Figure 8) the El Niño condition, which dominated the eastern tropical Pacific for over a year, is over. Sea surface temperatures along the coast of South America and along the equator have become significantly lower than the long-term mean temperatures. Normally, cooling of the Peru Current and its equatorial extension takes place in May. However, to the east of 100°W and south of the equator cooling of surface waters was great enough in May 1973 to produce anomalies up to 6° F (3.3° C) east of the Galapagos Islands where the equatorial front has once again become a dominant feature. Surface winds and pressures were slightly above normal in May over the south Pacific east of 100°W. Apparently the southeast trades have become sufficiently reestablished to eliminate the positive surface temperature anomalies that were present during the El Niño period and induce negative anomalies in their place.

North of the equator there has been very little change in the anomaly patterns. The sea surface temperatures over the fishing grounds continue to warm up at a normal rate over most of the area. East of 95°W small positive anomalies suggest that the intertropical convergence zone will be quite active in June. Near the equator and east of 90°W the positive anomaly adjacent to a large negative anomaly (Figure 8) is characteristic of the development of a very intense equatorial, ocean front between the Galapagos and the coast of Ecuador.

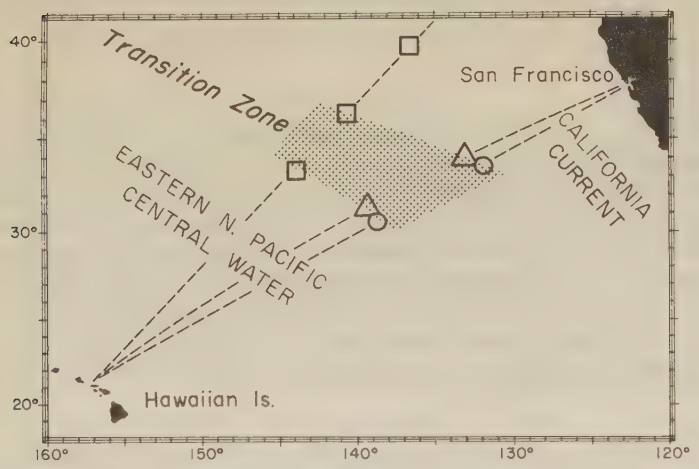
Subsurface Temperature Structure in the Northeast Pacific Ocean

J. F. T. SAUR

BACKGROUND

Water mass boundaries which include oceanic fronts are of particular interest because of their possible influence upon the migration and concentration of fish. In the area of observations between San Francisco and Hawaii there are two primary water masses: 1) the California Current waters which are mainly cool and low salinity sub-arctic waters undergoing continuous modification in their southward movement along the coast and 2) the eastern North Pacific Central waters which are warmer and higher in salinity. Between these lies a transition zone having temperatures and salinities characteristic of a mixture of the two primary water masses. The limits of this transition zone can usually be identified by relatively sharp horizontal changes in surface salinity and step-like changes in the sub-surface isotherms. The largest change in surface salinity generally occurs at the western edge of the transition zone. In early spring vertical temperature profiles in the transition zone exhibit complex minimum-maximum structure at 50 to 150 meters below the surface. In late spring warming of the surface layers tends to eliminate the minimum-maximum structure and an intermediate layer of little vertical temperature change occurs. For example, compare the complex vertical profile in early May at station 4 (Figure 10) with that at station 4 in late May (Figure 11).

The location of the two boundaries observed on the San Francisco-Hawaii route in April and May 1973 sections are shown below on plate 5.



○ APRIL 19-22, 1973
CHEVRON MISSISSIPPI

△ MAY 19-23, 1973
HAWAIIAN ENTERPRISE

□ MAY 5-11, 1973
TOWNSEND CROMWELL

PLATE 5.—POSITIONS OF OCEANIC FRONTS.

In early May the oceanographic research vessel Townsend Cromwell detected three fronts on the route from Hawaii to Seattle. Their positions are also shown on plate 5. The strongest front of the three was closer to Hawaii and is the same boundary as that between North Pacific Central water and transition zone on the Hawaii-San Francisco route. The middle front on the Seattle route may be continuous with the California Current front on the San Francisco route, as depicted above, but this is less certain.

MAY 1973

A partial section of subsurface temperature between San Francisco and Hawaii for the period of May 5-7, 1973 is shown in Figure 10, and a nearly complete section for May 19-23, 1973, in Figure 11. The observations for both were taken from the SS Hawaiian Enterprise.

The monthly net transfer of heat into the ocean through the surface on the average is greatest in May, June and July, along the San Francisco-Hawaii route. The largest values are found near the California Coast, but because of the advection of heat out of the area by the California Current, the rise of ocean surface temperatures and heat content of the upper 100 meters does not exceed that along the remainder of the section. Very close to the coast the temperatures may actually decrease if there is strong upwelling.

This year there was little warming during the first part of May as compared with the temperatures of the April 17-22 observations in last month's issue. However, pronounced warming occurred during the latter part of the month, so on the average there was an increase in the heat content of the 0-100 meter layer of 0.9° F (0.5° C) to 1.8° F (1.0° C). The greatest increase in the region of observations occurred between 200 and 500 miles from the California Coast, but there were no observations nearer the coast. The depths of the mixed or nearly-mixed surface layer decreased to 50 meters or less at all stations.

The transition zone between the waters of the California Current and the North Pacific water was nearly the same width as in April and at approximately the same location. The boundary with the California Current was slightly west of 133°W (between stations 4 and 5, Figure 11) about 550 miles from the coast. The boundary with the North Pacific Central waters was near 141°W (between stations 8 and 9, Figure 11) about 950 miles out. This latter boundary or front exhibited the greater horizontal change in surface salinity and temperature.

The main thermocline, represented by the 12° and 13° isotherms shows a gradual downward slope from the coast to 1000 miles out. In 1972 there was a sharp downward slope around 800 miles out.

It continues to appear that the transition zone is more diffuse and broader this year than last, its eastern edge is closer to the coast and the flow of the California Current is somewhat weaker.

Airborne Infrared Sea Surface Temperature Survey Off San Diego

J. L. SQUIRE

A sea surface temperature survey will be conducted each week, April through October for the important fishing areas off San Diego. These surveys are part of a cooperative program between the NMFS La Jolla Laboratory and the California Department of Fish and Game to evaluate the effects of temperature changes on the distribution of important game fish species such as yellowtail, bonito, barracuda, white sea-bass and other species entering the sport catch.

The first series of monthly charts appeared in the April issue of Fishing Information.

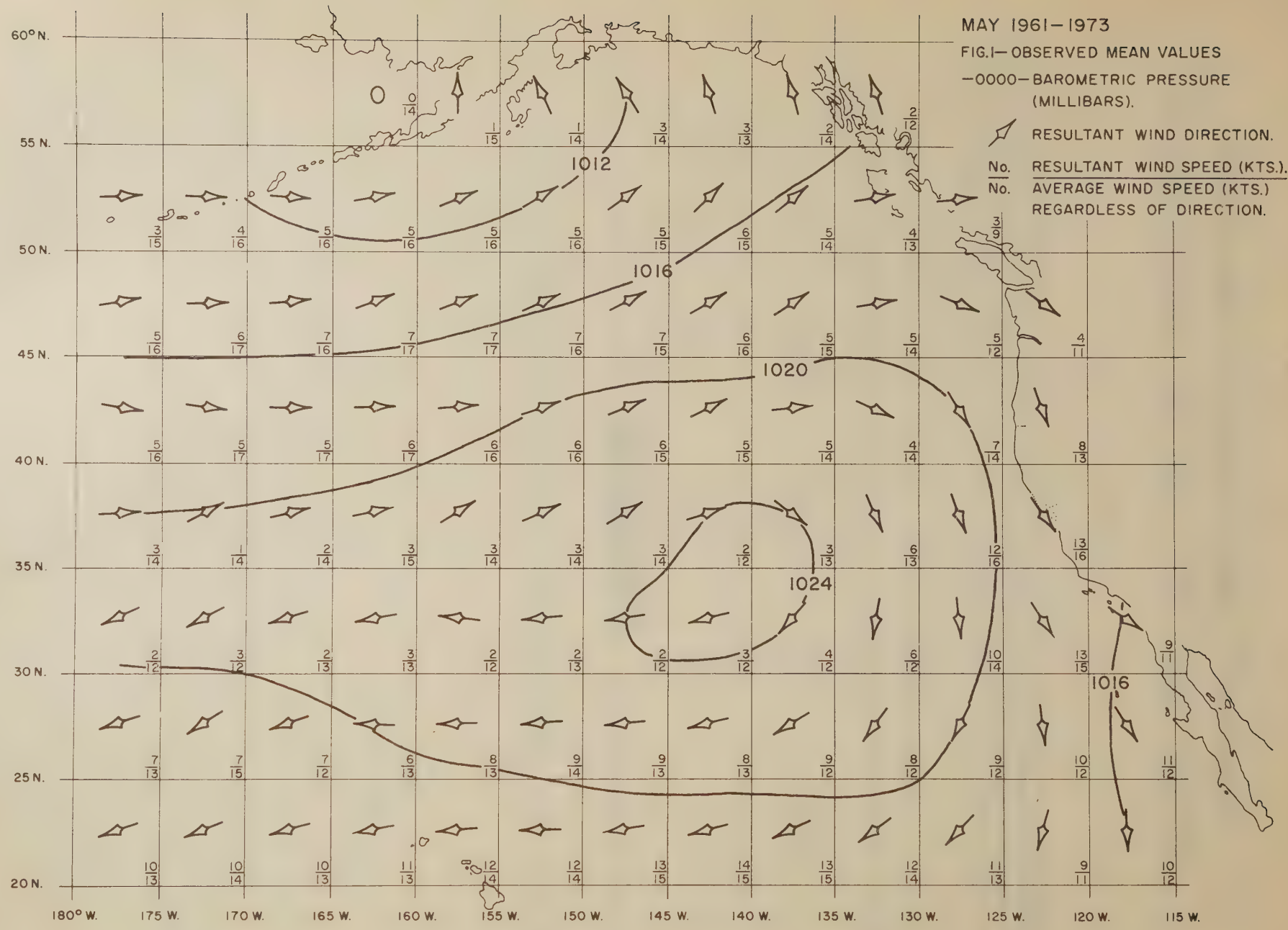
During May 1973 four survey flights were conducted and the approximate temperatures at the major fishing locations in ° F (for conversion to ° C consult the charts) were as follows:

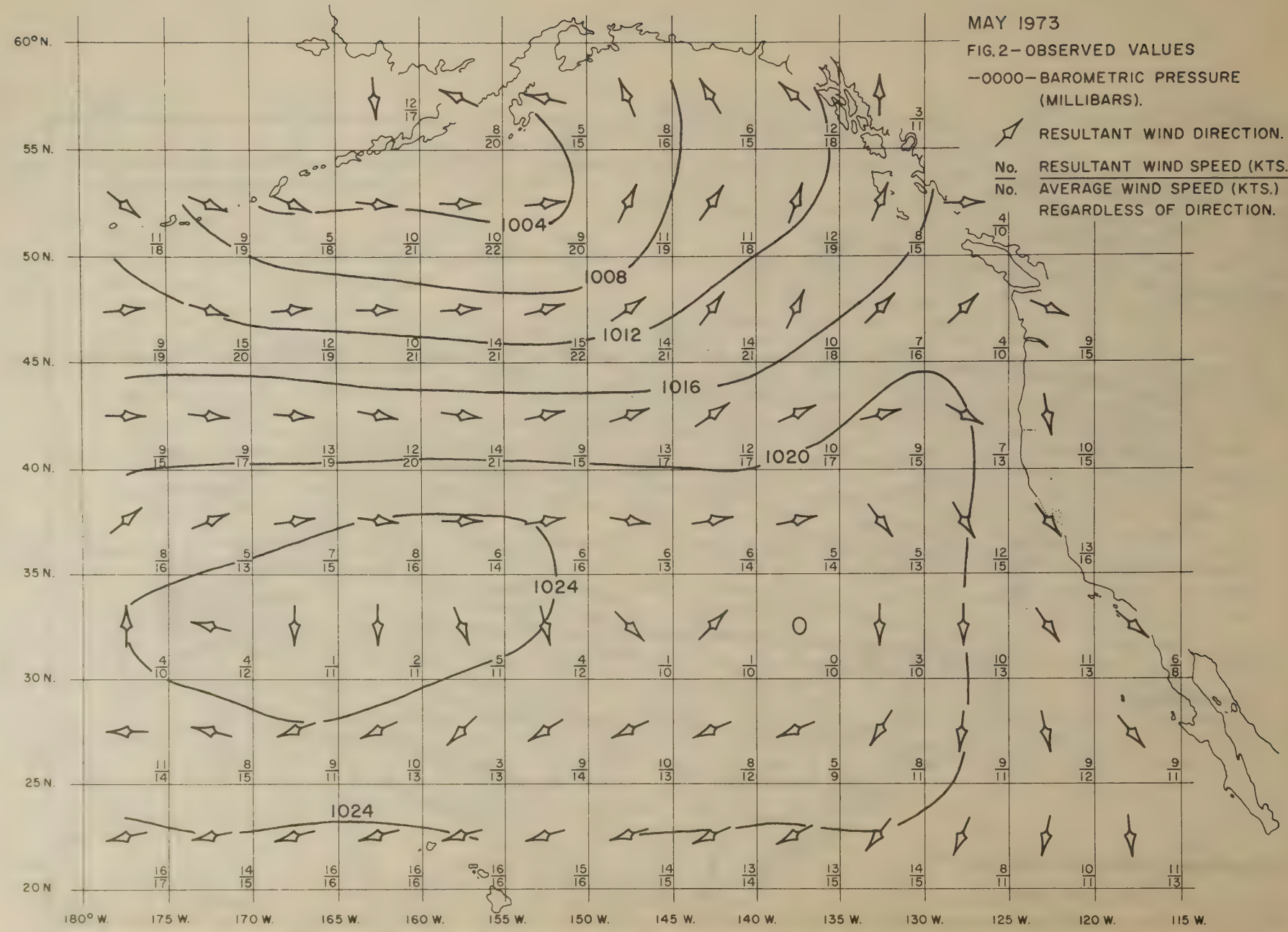
Survey Date	La Jolla Kelp Area	Pt. Loma Kelp Area	Tijuana Kelp	Coronado Islands
May 7, 1973	61°	59-60°	58°	58°
May 14, 1973	60°	59-60°	59°	59°
May 21, 1973	59-60°	59-60°	59°	59°
May 31, 1973	64-65°	63-65°	64°	63°

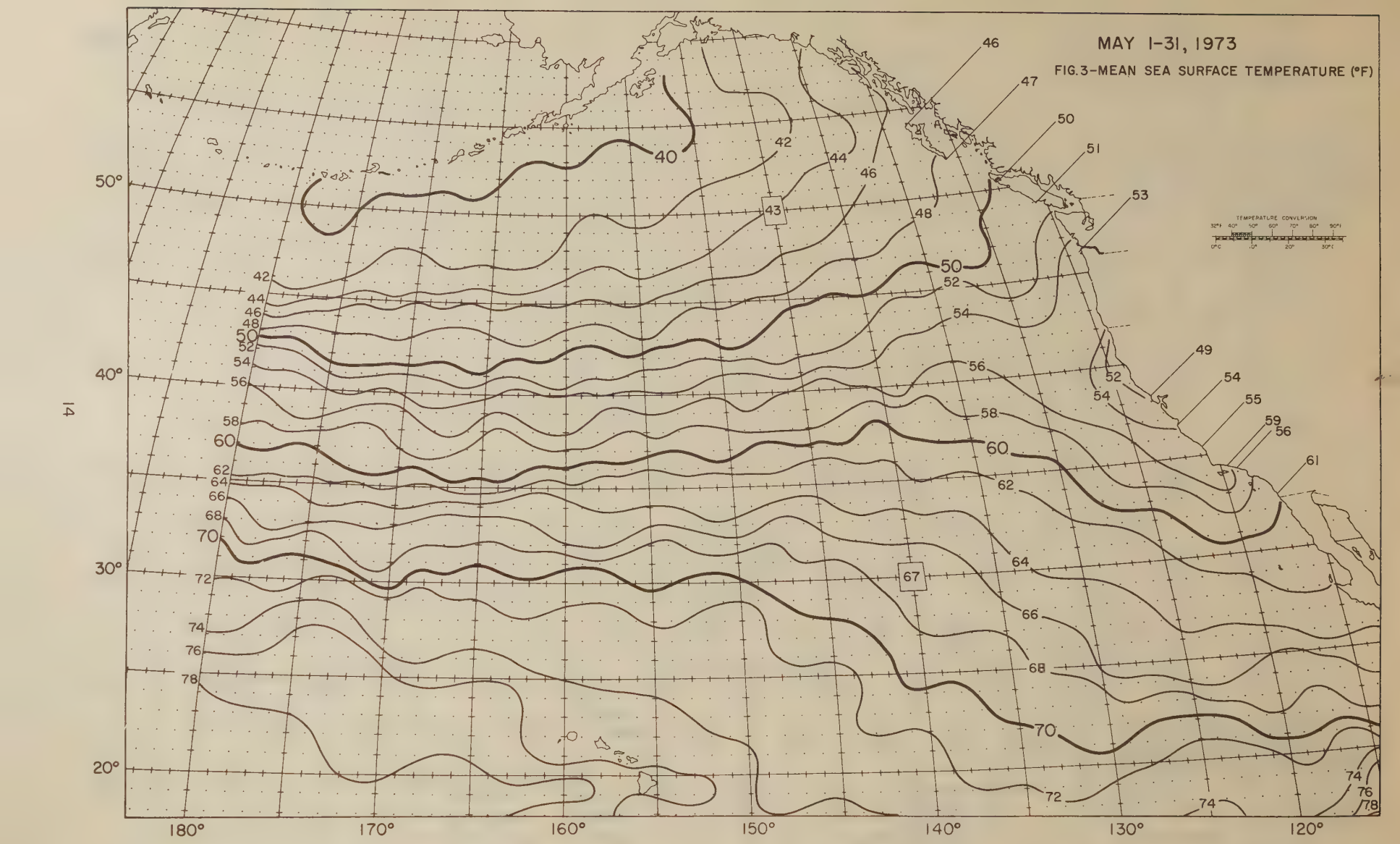
Temperature data indicates a substantial increase in temperature of 4° to 5° F in all areas between May 21-31, 1973.

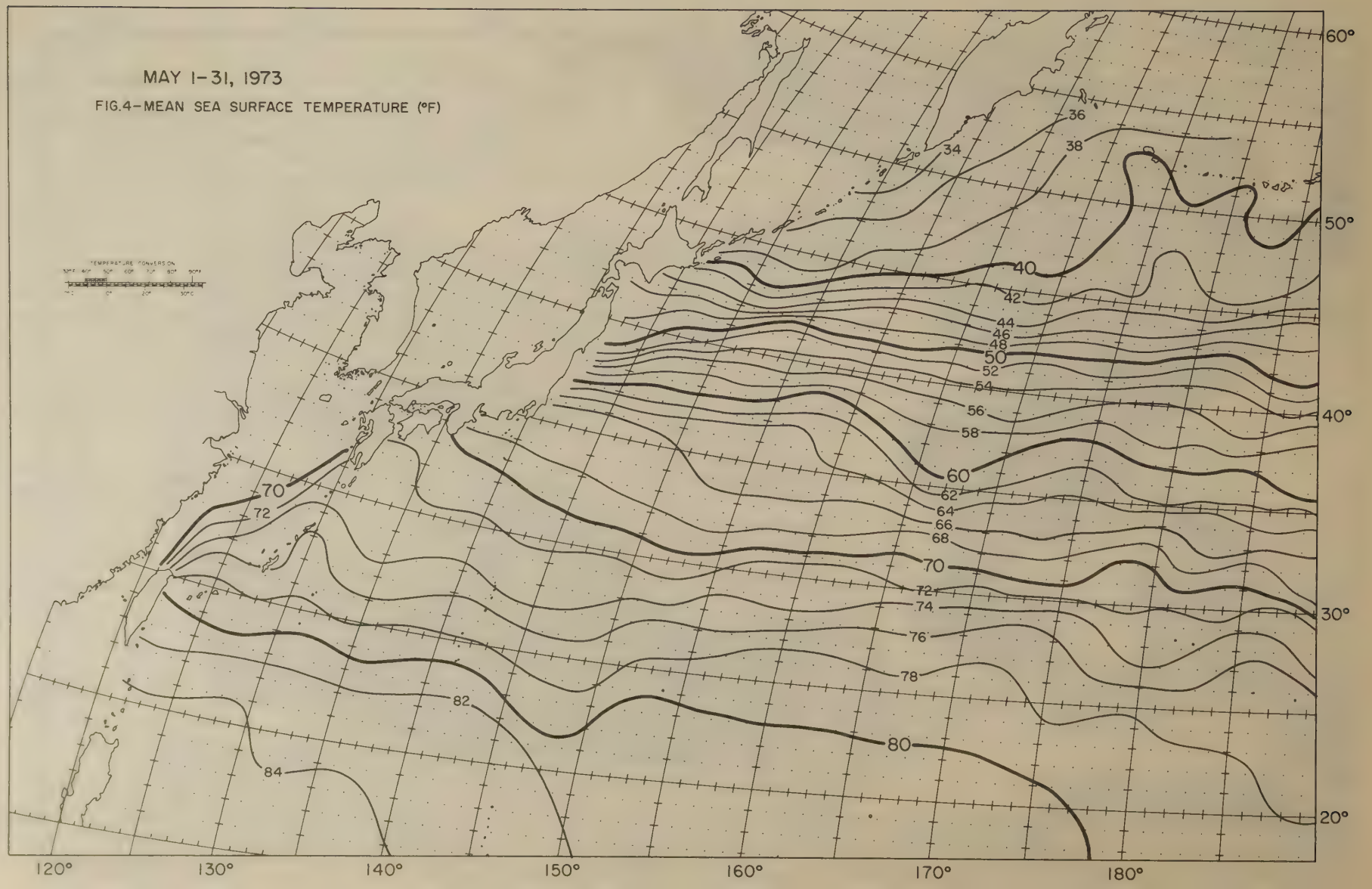
In 1972 temperatures were 2° to 3° F warmer than those measured in 1973. Temperatures taken in late May 1972, were, La Jolla kelp area, 67°; Pt. Loma kelp area, 67-68°; Tijuana kelp area 66°; and Coronado Islands, 67°

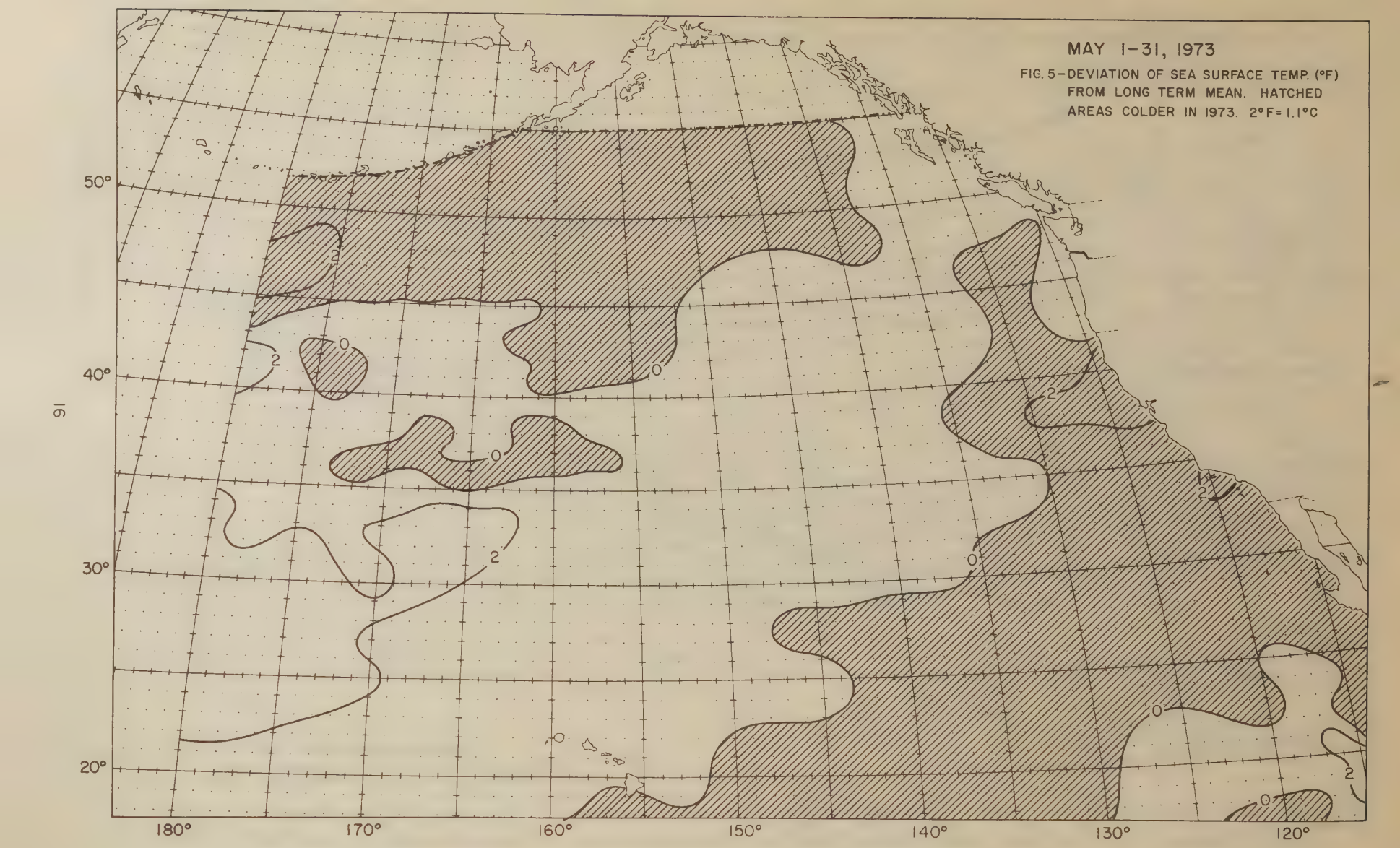
CHARTS

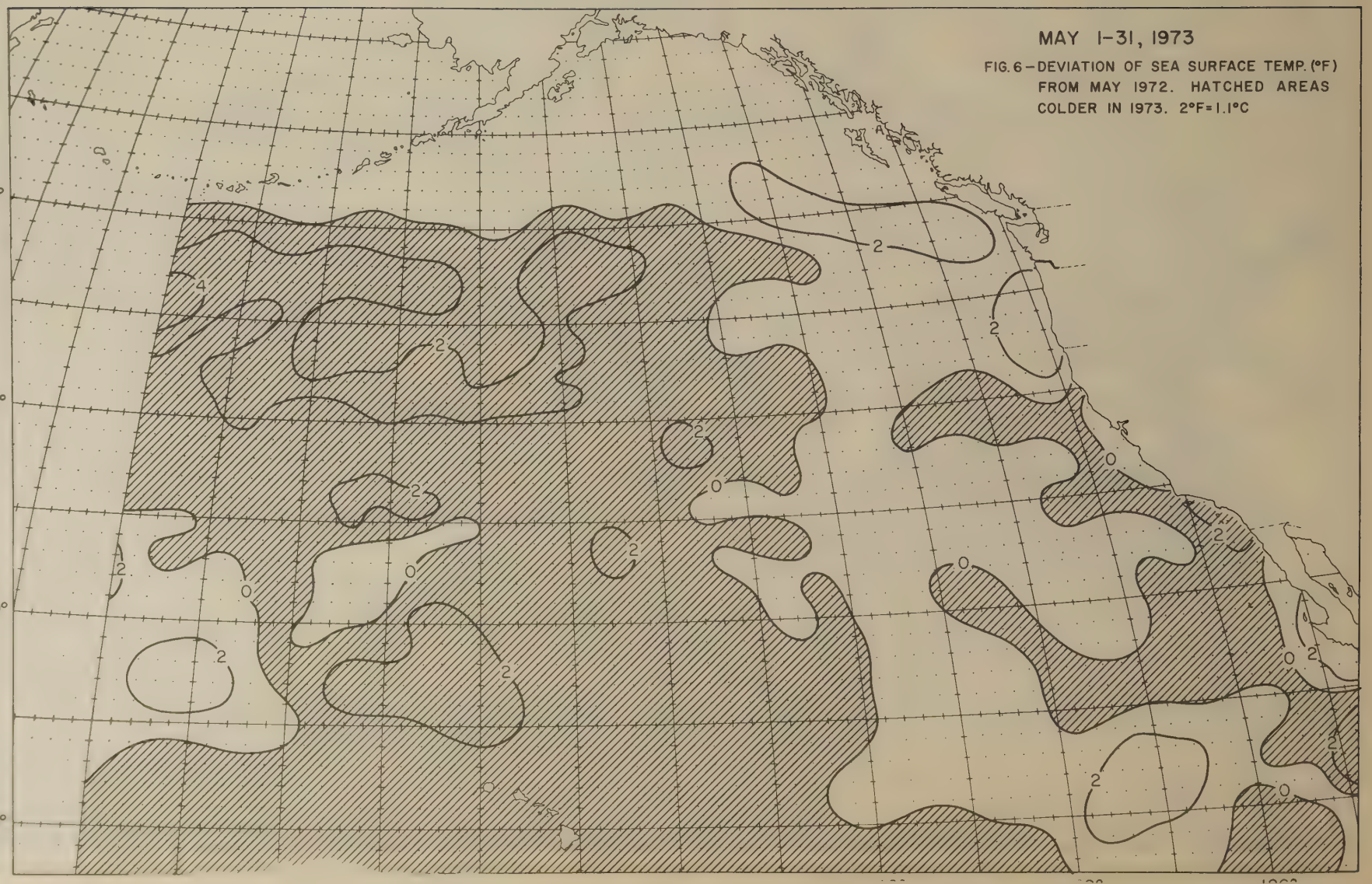

MAY 1961–1973
FIG.1– OBSERVED MEAN VALUES
–0000– BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
1016
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.

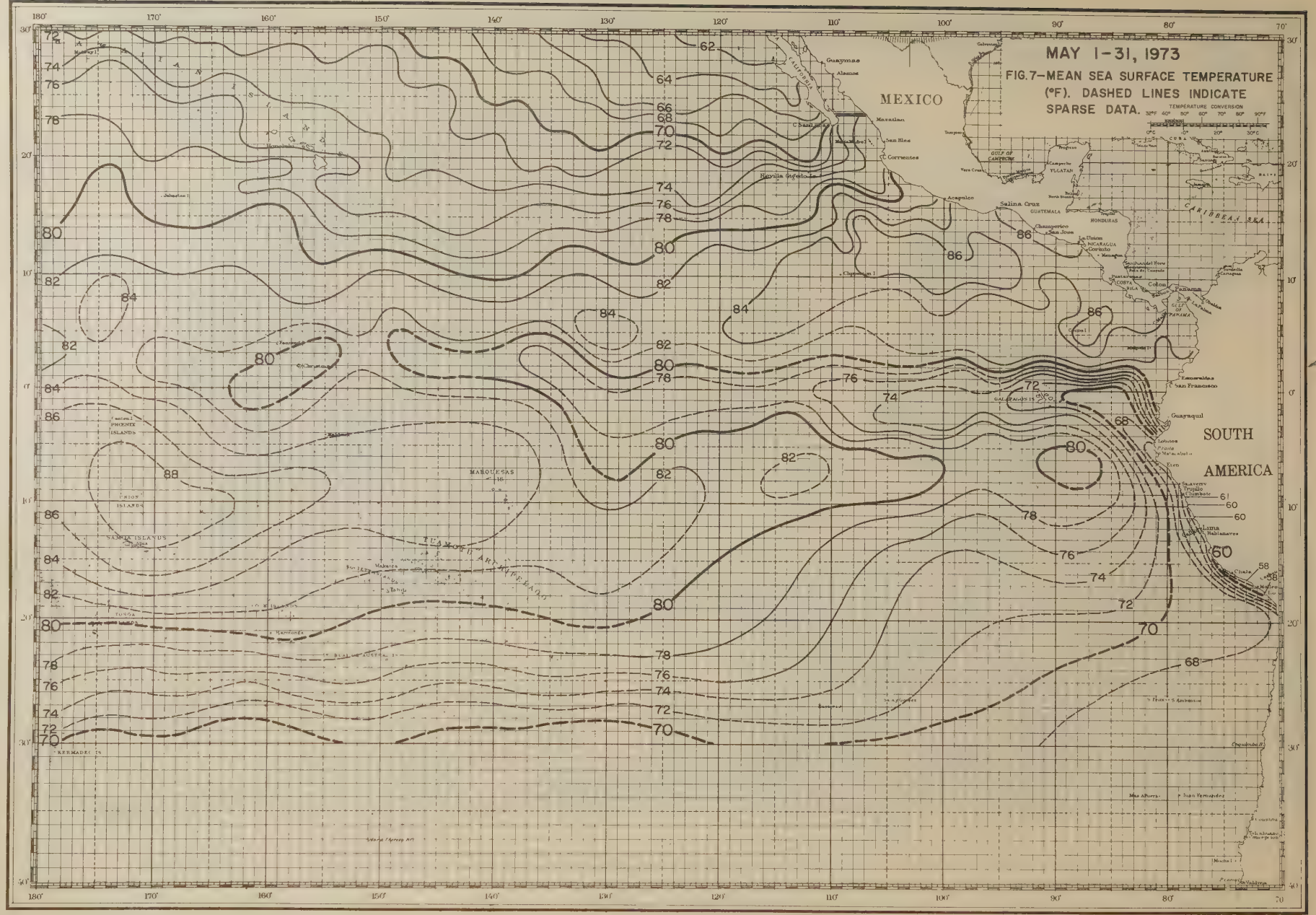

MAY 1973
FIG. 2 – OBSERVED VALUES
–0000– BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.
1004
1008
1012
1016
1020
1024
1024

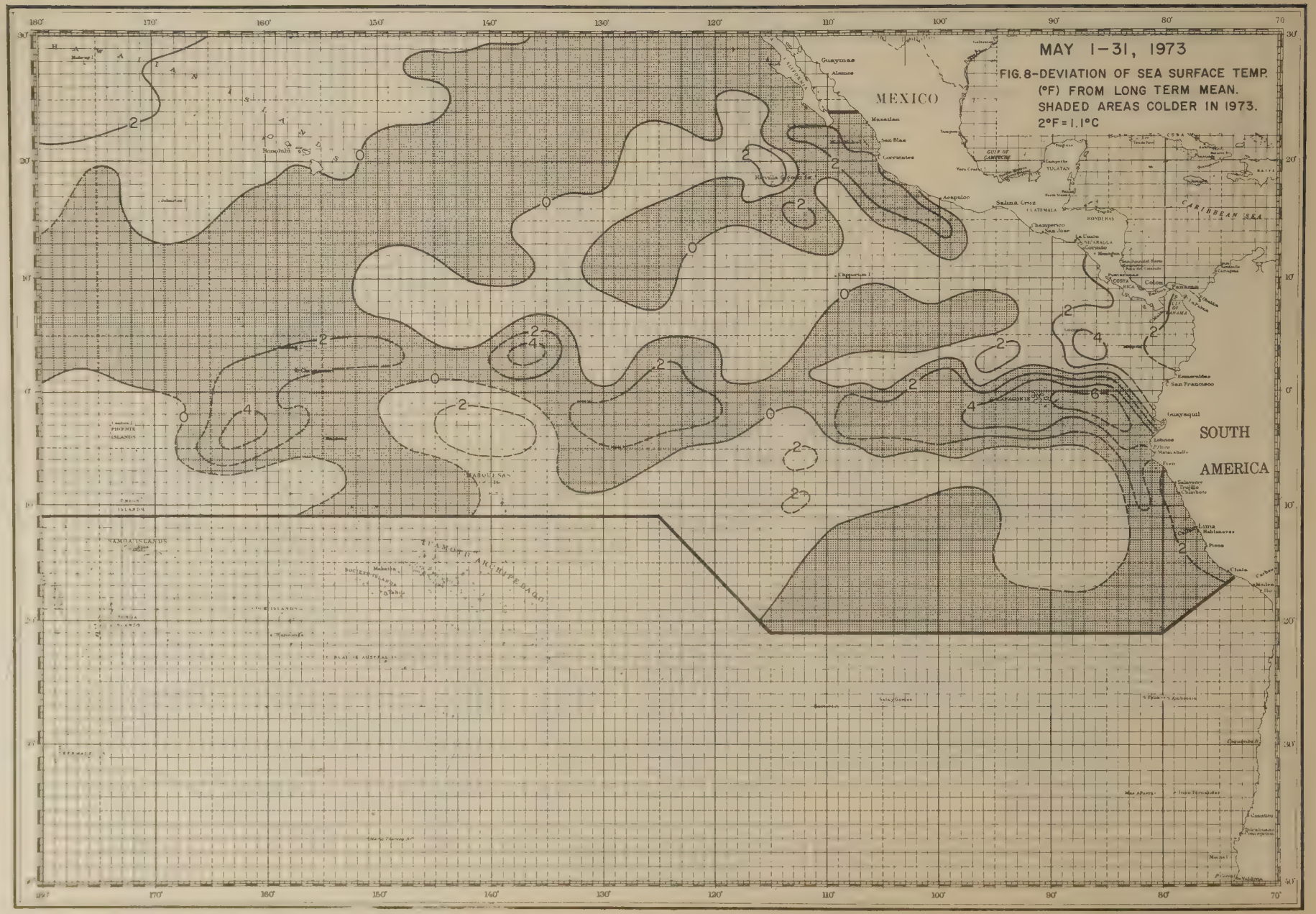

MAY 1-31, 1973
FIG.3-MEAN SEA SURFACE TEMPERATURE (°F)
TEMPERATURE CONVERSION
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
43
67


MAY 1-31, 1973
FIG.4-MEAN SEA SURFACE TEMPERATURE (°F)
TEMPERATURE CONVERSION
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
60°
50°
40°
30°
20°
120°
130°
140°
150°
160°
170°
180°


MAY 1-31, 1973
FIG. 5-DEVIATION OF SEA SURFACE TEMP. (°F) FROM LONG TERM MEAN. HATCHED AREAS COLDER IN 1973. 2°F = 1.1°C
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2


MAY 1-31, 1973
FIG. 6 – DEVIATION OF SEA SURFACE TEMP. (°F) FROM MAY 1972. HATCHED AREAS COLDER IN 1973. 2°F=1.1°C
50°
40°
30°
20°
4
2
0


MAY 1-31, 1973
FIG.7—MEAN SEA SURFACE TEMPERATURE (°F). DASHED LINES INDICATE SPARSE DATA.
TEMPERATURE CONVERSION
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CALIFORNIA
GULF OF PANAMA
GULF OF CAMPECHE
GALAPAGOS IS.
MARQUESAS
SAMOA ISLANDS
UNION ISLANDS
PHOENIX ISLANDS
TUAMOTU ARCHIPELAGO
Guaymas
Alamos
Mazatlan
San Blas
Corrientes
Acapulco
Salina Cruz
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
Panama
Colon
Esmeraldas
San Francisco
Guayaquil
Talara
Trujillo
Chimbote
Callao
Lima
Chile
Honolulu
Johnston I.
Palmyra I.
Christmas I.
Fanning I.
Tahiti
Easter I.
Juan Fernandez
Mas Afuera
Valdivia

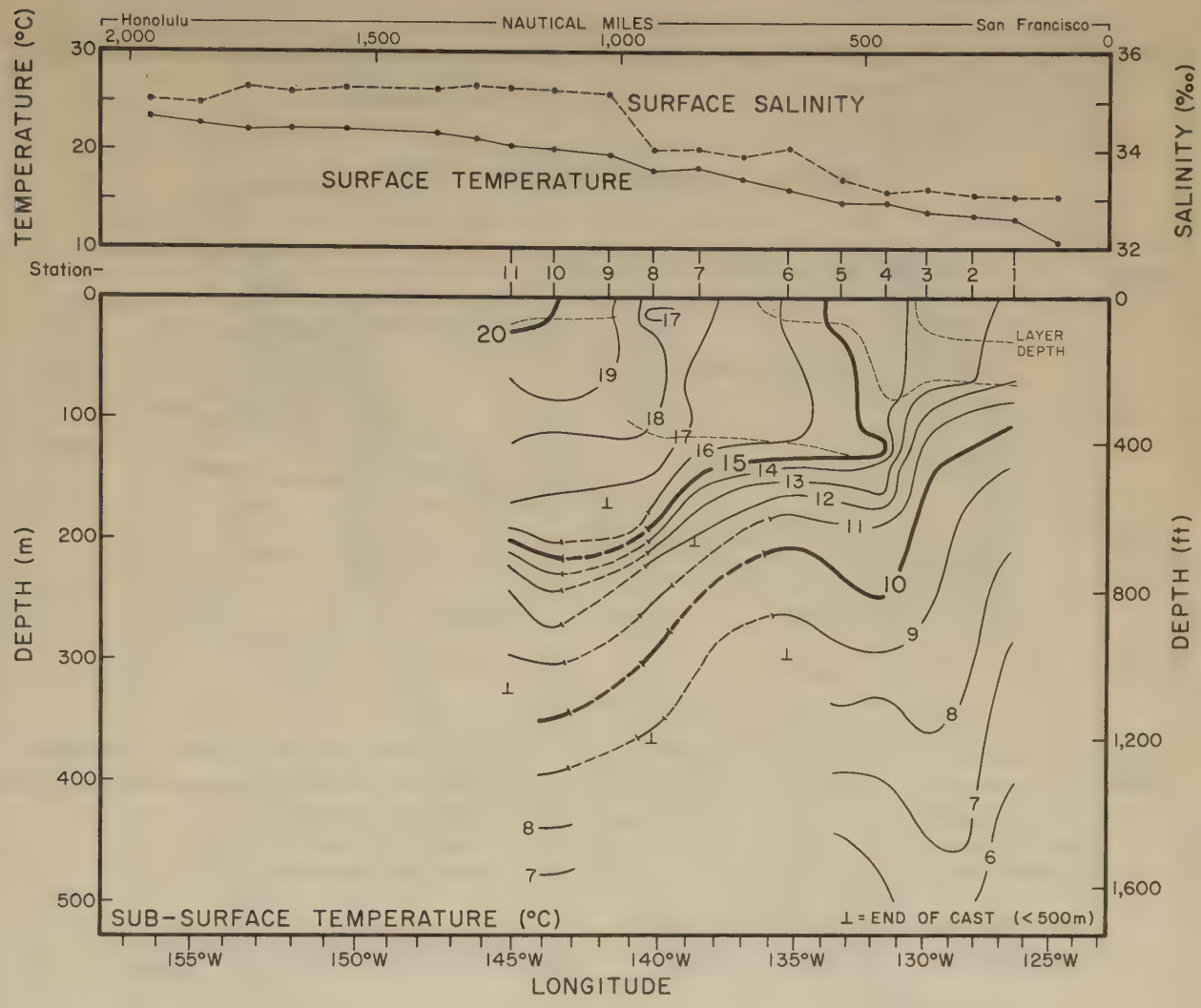

MAY 1–31, 1973
FIG. 8–DEVIATION OF SEA SURFACE TEMP. (°F) FROM LONG TERM MEAN. SHADED AREAS COLDER IN 1973.
2°F = 1.1°C
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GULF OF CALIFORNIA
Guaymas
Mazatlan
San Blas
Acapulco
Salina Cruz
Panama
Guayaquil
Lima
Chile
Honolulu
Galapagos Is.
Easter I.
Marquesas Is.
Tuamotu Archipelago
Tahiti
Samoa Islands
Tonga Islands
Fiji Islands
Phoenix Islands
Line Islands
Tokelau Is.
Cook Islands
Society Islands
Austral Is.
Pitcairn I.
Juan Fernandez Is.
Salas y Gomez
Ecuador
Peru
Colombia
Nicaragua
Costa Rica
Honduras
Guatemala
Yucatan
Cuba
Haiti
Jamaica
Caracas
Maracaibo
Trujillo
Chimbote
Callao
Arica
Iquique
Antofagasta
Coquimbo
Valparaiso
Concepcion
Talcahuano
Corral
Puerto Montt
Chiloe I.
Taitao Pen.
Tierra del Fuego
Strait of Magellan
Cape Horn
Juan Fernandez Is.
Nasca Ridge
Carnegie Ridge
Galapagos Rise
Albemarle I.
Isabela I.
Fernandina I.
Santa Cruz I.
San Cristobal I.
Española I.
Floreana I.
Santa Maria I.
Pinta I.
Marchena I.
Genovesa I.
Wolf I.
Darwin I.
Pinzon I.
Rabida I.
Seymour I.
Baltra I.
Santiago I.
Bartolome I.
Tower I.
Culpepper I.
Wenman I.
Guayaquil
Esmeraldas
San Francisco
Salaverry
Trujillo
Chimbote
Lima
Callao
Pisco
Arica
Iquique
Antofagasta
Coquimbo
Valparaiso
Concepcion
Talcahuano
Corral
Puerto Montt
Chiloe I.
Taitao Pen.
Tierra del Fuego
Strait of Magellan
Cape Horn
Juan Fernandez Is.
Nasca Ridge
Carnegie Ridge
Galapagos Rise
Albemarle I.
Isabela I.
Fernandina I.
Santa Cruz I.
San Cristobal I.
Española I.
Floreana I.
Santa Maria I.
Pinta I.
Marchena I.
Genovesa I.
Wolf I.
Darwin I.
Pinzon I.
Rabida I.
Seymour I.
Baltra I.
Santiago I.
Bartolome I.
Tower I.
Culpepper I.
Wenman I.

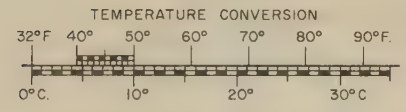
NOTICE

Beginning this month the chart showing the year-to-year anomalies in the sea surface temperature in the eastern tropical Pacific will no longer be included. Interested readers may obtain reasonably accurate anomalies by comparing the sea surface isotherms of the current month with those for the corresponding month and locations in Fishing Information for the previous year. The user is reminded that dashed isotherms on the tropical sea surface temperature analysis are used where data are sparse and climatology may have been given considerable weight in the analysis.

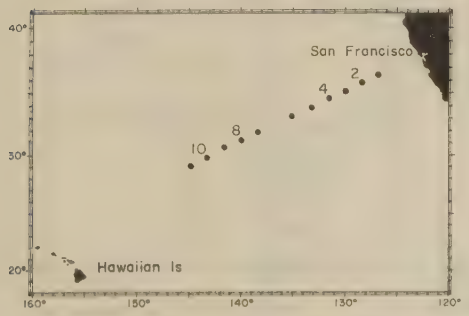
MAY 5–7, 1973
SS HAWAIIAN ENTERPRISE, Voyage 64

FIGURE 10.

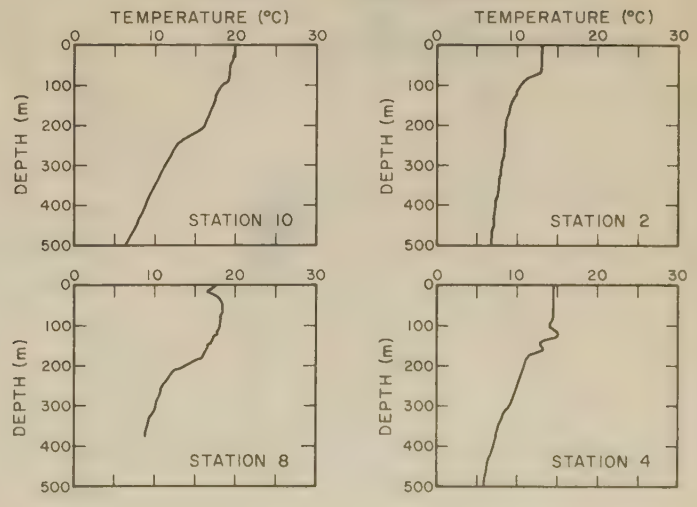




STATION POSITIONS Voy. 64

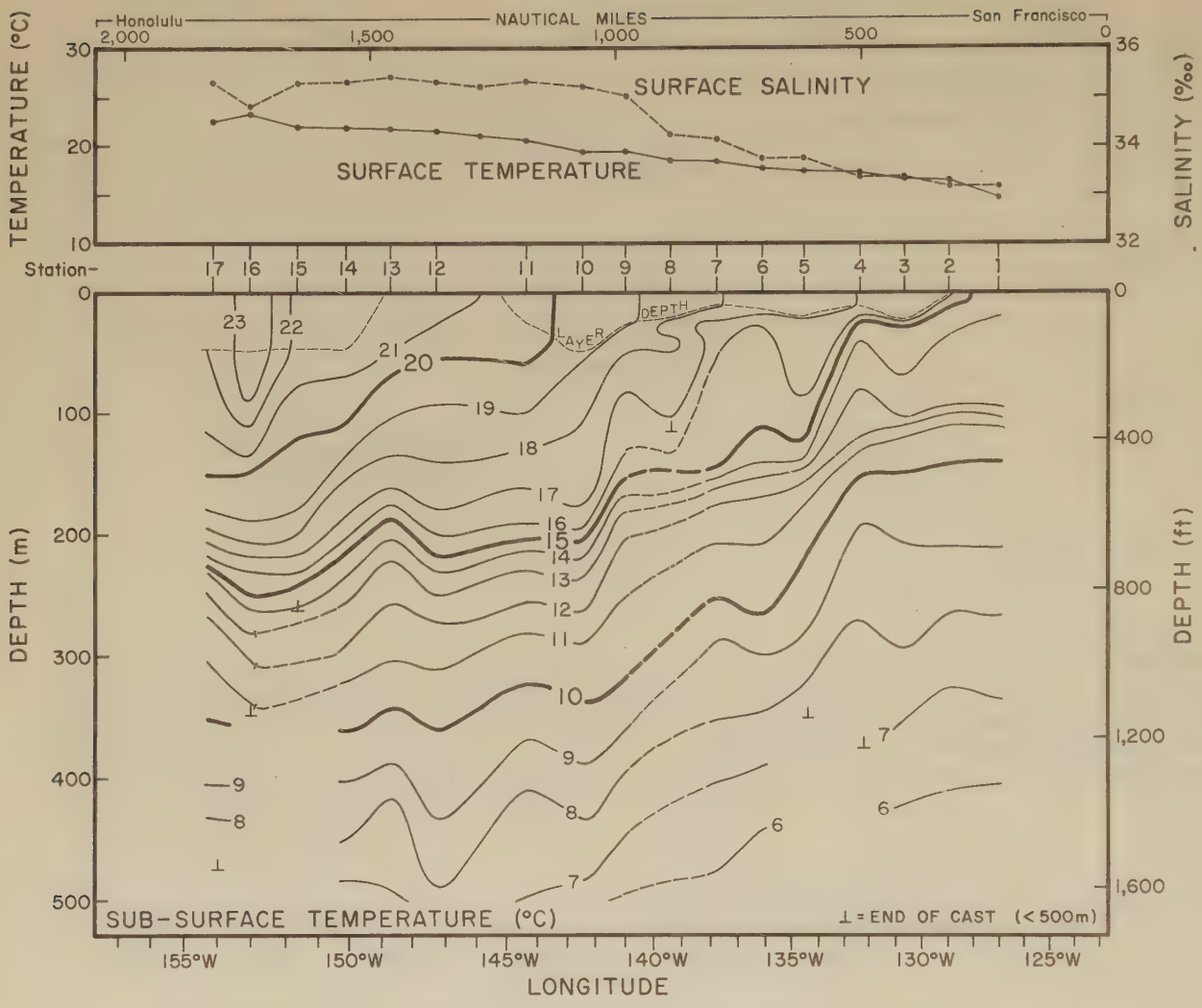


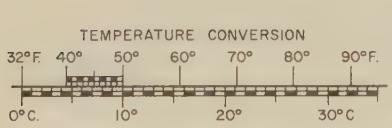
SELECTED STATION PROFILES

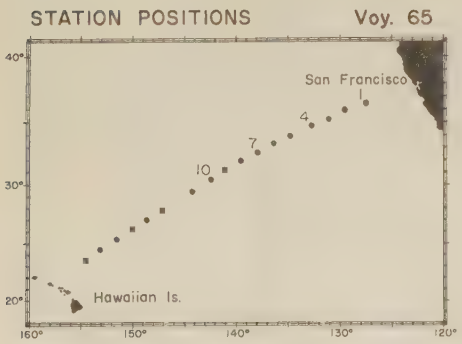


MAY 19–23, 1973
SS HAWAIIAN ENTERPRISE, Voyage 65

FIGURE 11.







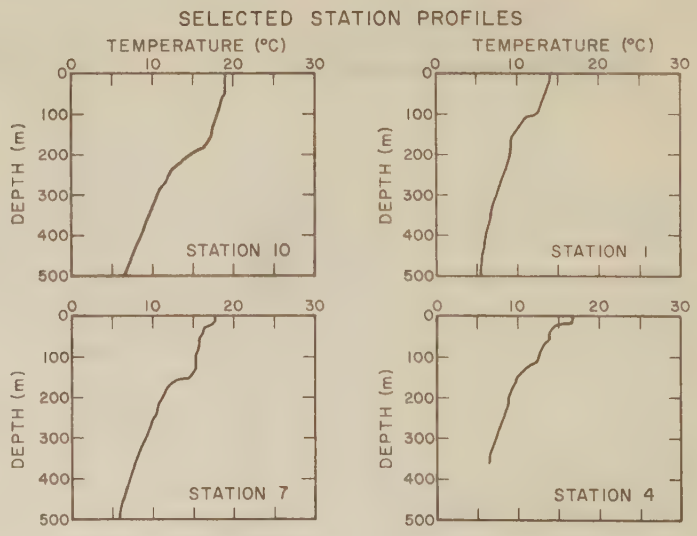
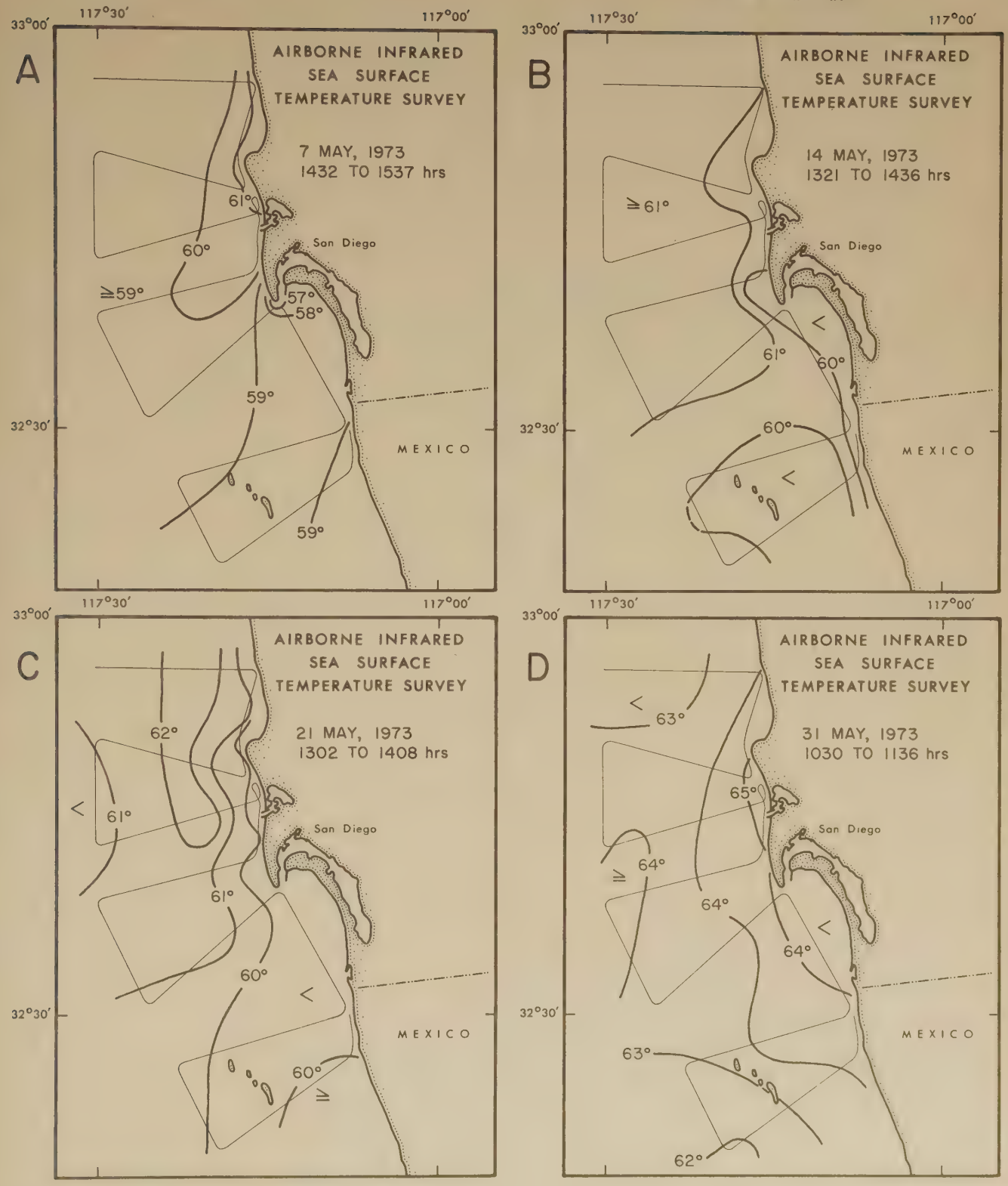
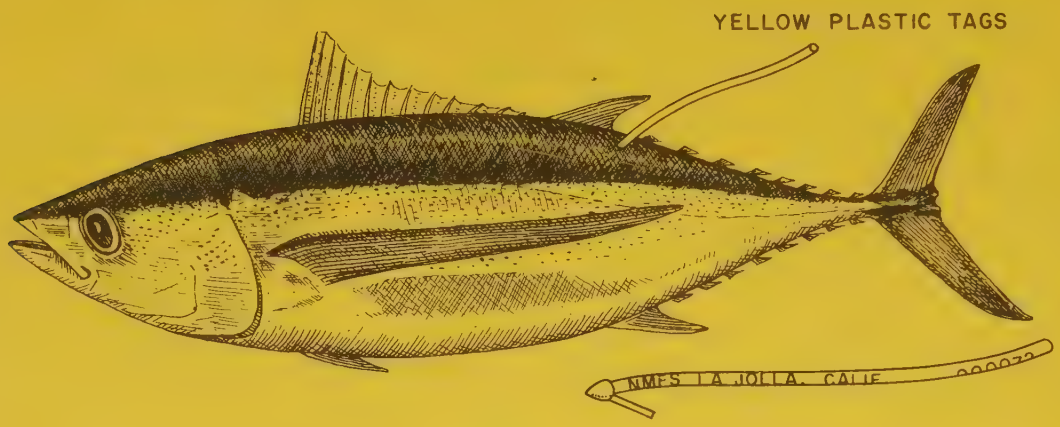


FIGURE 12- MAY 1973



$ REWARD $

FOR ALBACORE TUNA TAGS



THE
NATIONAL MARINE FISHERIES SERVICE WILL PAY $ 2.00 FOR EACH TAG RETURNED (SOME FISH HAVE MORE THAN ONE TAG).

THE
AMERICAN FISHERMEN'S RESEARCH FOUNDATION WILL AWARD CASH PRIZES FOR THE NUMBERS DRAWN IN AN ANNUAL LOTTERY.

WRITE:

- WHERE
- WHEN
- HOW

} *FISH WAS CAUGHT*

- LENGTH OF FISH (TIP OF LOWER JAW TO FORK OF TAIL)

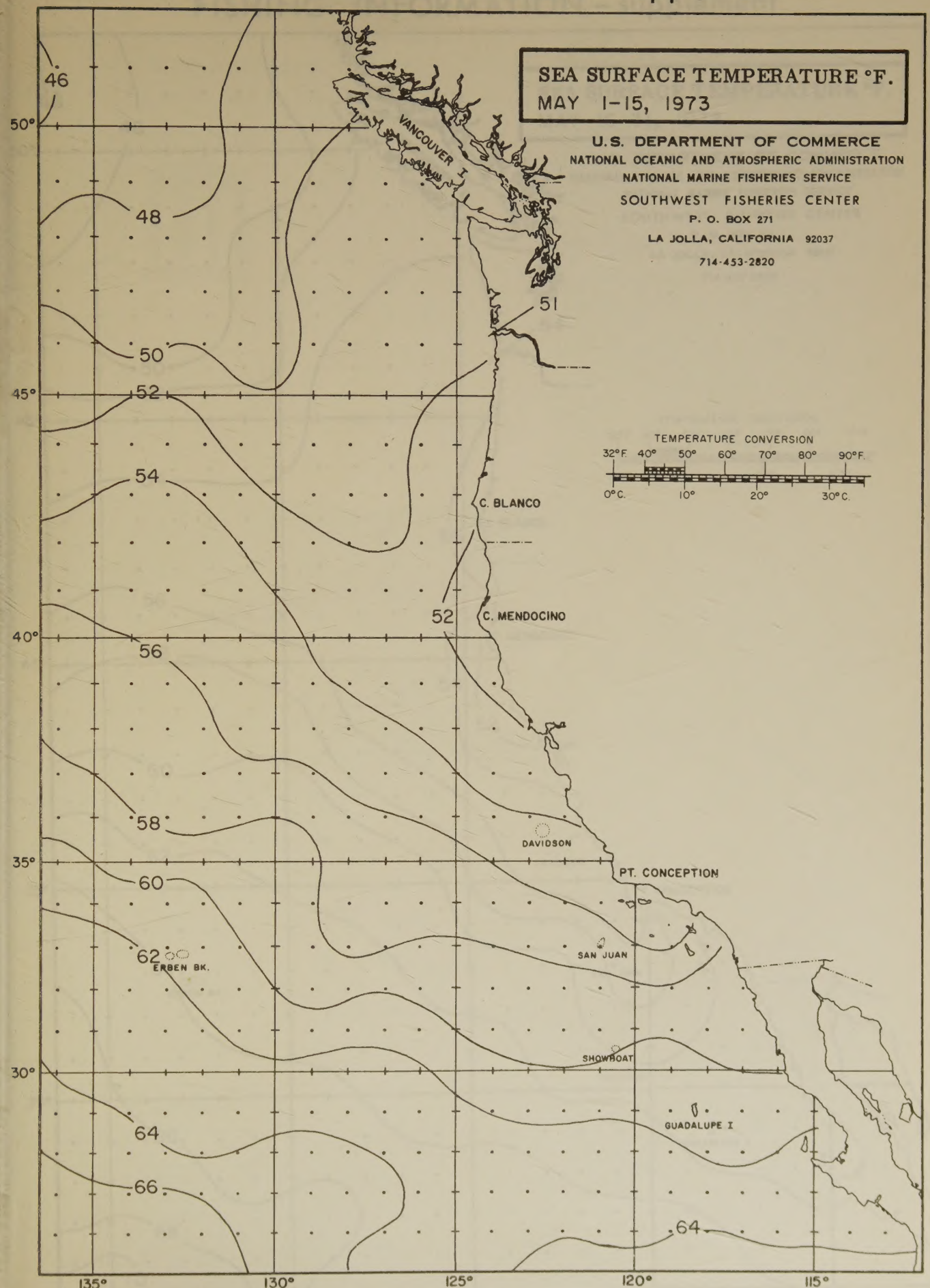
FORWARD TO NMFS ADDRESS ON TAG OR TO AFRF
4904 N. HARBOR DRIVE, SAN DIEGO, CALIFORNIA

Daily broadcasts of albacore fishing information prepared by NOAA's National Marine Fisheries Service will be transmitted over marine radiobands starting July 9 and extending to October 31 or until the season ends. The broadcasts will be made on weekdays and Saturday mornings by the following radio stations:

WWD (La Jolla, California) on SSB carrier frequencies 4409.4, 8644.1, 8789.6, and 13147.5 kHz at 0615 and 1745 PDT on weekdays and 0715 on Saturdays.
KFX (Astoria Marine Operator) on 2598 kHz at 0630 and 1945 PDT.
KRED (Eureka, California) on commercial AM 1480 kHz at 0600 and 2000 PDT.
NMC (Point Reyes Coast Guard) on AM compatible frequency 2670 and on SSB carrier frequencies 4383.8, 8732.1, 13147.5 kHz at 0645 and 1945 PDT.

(to determine the upper sideband assigned frequencies for tunable receivers add 1.4 kHz to WWD and NMC carrier frequencies)

FISHING INFORMATION – supplement



FISHING INFORMATION – supplement